FUSER SHEET STRIPPING SYSTEM

[0001] Disclosed in the embodiments herein is an improved system for stripping sheets from a thermal roll in a printing system with a stripping system combining a positive mechanical sheet engaging stripping edge stripping system with a cooperative integral specially directed pneumatic sheet engaging airflow system therein.

[0002] The accurate and reliable transport of print media (copy sheets), particularly cut sheet paper, through the various workstations of printing systems is a well known problem, particularly due to the highly variable nature of such materials. Paper jams are one of the main causes of copying machine shutdowns. A particularly difficult problem in modern xerographic or phase change ink jet (hot wax) or other printing systems with fusing or other thermal rolls is the reliable and consistent stripping of the flimsy print media sheets off of one or both of the mating image fusing surfaces of roll fusers, especially those with oiled or oil-releasing surfaces, which oil may be needed to prevent image offset of the heated toner images onto one or both of the fuser roll surfaces. Due to practical constraints, this must generally be done as closely as possible to the fuser surface, yet without causing excess wear or damage of the surface, and without creasing, wrinkling, edge stubbing or otherwise damaging the sheet being stripped.

[0003] Various types of plastic and other "stripper finger" systems riding against the surface of one or both fuser rolls are well known in the art. One recent example thereof is disclosed in Xerox Corp. U.S. 6,490,428 issued December 3, 2002 to Fromm et al, as well as various other fuser stripper patents cited therein.

[0004] Also in the fuser art, air knife fuser "release aids" 61, 62 are briefly described in U.S. 6,582,222, Col. 10, lines 36-45, issued June 24, 2003 to

Chen et al. Also, U.S. 3,716,221 issued February 13, 1973 to Gorka et al in Col. 6, lines 48-53, briefly describes an air knife 87 and a stripping and guide blade 88 positioned against the backup roller 12 of the fuser.

[0005] Further by way of background, various stripping systems have also been utilized for the stripping of print media sheets from electrostatic photoreceptor surfaces (although that is obviously a quite different environment). One such system is an air puffer applying a jet of air towards the lead edge of the copy sheet to initiate its separation from the imaging surface, as described, for example, in U.S. 3,062,536 to J. Rutkus, Jr. et al. Other mechanical stripping systems use stripping fingers for catching the lead edge of the copy sheet. Another example of such a mechanical stripping system is disclosed in U.S. 3,578,859 issued May 18, 1971. This patent also discloses an example of a vacuum transport system closely adjacent the photoreceptor and forming a part overall stripping system after stripping of the lead edge has been initiated.

[0006] Xerox Corp. U.S. 4,060,235 issued November 29, 1977 shows a vacuum stripping system in which the vacuum is applied through a self-lifting stripper head. However, that stripping head does not have a mechanical stripping edge.

[0007] Incidentally, as known in the art, sheet stripping systems typically use stripper fingers only as a "back-up" system for stripping certain occasional sheets whose low weight, high humidity, curl, or other condition renders those sheets particularly difficult to self-strip from the imaging surface. The property of the copy sheet providing such self-stripping action is generally referred to as its "beam strength," or "stiffness," which is proportional to its cross-sectional moment of inertia. The effectiveness of the sheet self-stripping action is increased by increasing the curvature of the imaging surface (in the direction of the imaging surface). However, that is limited by practical considerations.

[0008] A specific feature of the specific embodiment disclosed herein is to provide a printer with a roll fuser having at least one rotating roll surface, in which roll fuser a flimsy sheet being printed is fused by moving through said roll fuser lead edge first, engaging said at least one roll, a stripping apparatus is provided for assisting the stripping of said flimsy sheet from said at least one roll of said roll fuser, said stripping apparatus having at least one stripper finger with an extending stripping edge which is positionable to engage under said leading edge of said sheet on said at least one roll of said roll fuser to lift said leading edge of said flimsy sheet away from said at least one roll, further including a pneumatic system for blowing air under said leading edge of said flimsy sheet to lift said leading edge of said flimsy sheet in cooperation with said stripper finger stripping edge lifting of said leading edge of said flimsy sheet.

[0009] Further specific features disclosed in the embodiment herein, individually or in combination, include those wherein said pneumatic system for blowing air under said leading edge of said flimsy sheet includes a pneumatic conduit extending towards said stripping edge and opening adjacent to said stripping edge of said stripper finger; and/or wherein said pneumatic system for blowing air under said leading edge of said flimsy sheet includes an airflow path in said stripper finger extending towards said stripping edge and opening closely adjacent to said stripping edge of said stripper finger; and/or a sheet stripping apparatus for assisting the stripping of flimsy sheets from a moving surface comprising at least one stripper finger having an extending stripping edge positionable to engage under the leading edge of a sheet on said moving surface to lift said leading edge of said sheet away from said moving surface, further including a pneumatic system for blowing air under said leading edge of said sheet to lift said leading edge of said sheet in cooperation with said stripper finger stripping edge lifting of said leading edge of said sheet; and/or wherein said pneumatic system for blowing air under said leading edge of said sheet includes a pneumatic conduit extending towards said stripping edge and opening adjacent to said stripping edge; and/or wherein said pneumatic system for

blowing air under said leading edge of said sheet includes an airflow path in said stripper finger extending towards said stripping edge and opening upwardly closely adjacent to said stripping edge; and/or wherein said moving surface is a roll of a xerographic fuser and said sheet is a xerographically printed sheet being fused by said xerographic fuser; and/or a method of assisting the stripping of flimsy sheets adhering to a moving surface comprising engaging the leading edge of a sheet on said moving surface to lift said leading edge of said sheet away from said moving surface with an extended stripping edge of at least one stripper finger, further including blowing air under said leading edge of said sheet closely adjacent to said stripping edge sufficiently to additionally lift said leading edge of said sheet in an increased radius in cooperation with said stripper finger stripping edge lifting of said leading edge of said sheet.; and/or wherein said blowing air under said leading edge of said sheet is provided via a pneumatic conduit extending through said stripper finger towards said stripping edge and opening closely adjacent to said stripping edge and/or wherein said blowing air under said leading edge of said sheet comprises providing said blowing air through an airflow path inside of said stripper finger extending towards said stripping edge and opening upwardly closely adjacent to said stripping edge; and/or wherein said moving surface is a roll of a xerographic fuser and said sheet is a xerographically printed sheet being fused by said xerographic fuser; and/or a printer with a roll fuser having at least one rotating roll surface, through which roll fuser flimsy sheets are movable, a sheet stripping apparatus is provided for assisting the stripping of said flimsy sheets from said rotating roll surface of said roll fuser, said stripping apparatus having at least one stripper finger with an extending stripping edge positionable to engage a flimsy sheets on said rotating roll surface, further including a pneumatic system for blowing air between said flimsy sheet and said rotating roll surface for additional flimsy sheet stripping reliability therefrom, said pneumatic system including at least one pneumatic conduit extending through at least part of said stripper finger towards said stripping edge, said pneumatic conduit having at least one pneumatic opening closely

adjacent to said stripping edge of said stripper finger; and/or wherein said pneumatic system further includes a second pneumatic opening in said stripper finger facing said rotating roll surface to provide an air bearing between said stripper finger and said at least one rotating roll surface; and/or wherein said pneumatic system provides sufficient airflow under the leading edge area of a sheet engaged by said stripping edge to lift said leading edge area of said sheet in an increased radius.

[0010] The term "reproduction apparatus" or "printer" as used herein broadly encompasses various printers, copiers or multifunction machines or systems, xerographic or otherwise, unless otherwise defined in a claim. The term "sheet" herein refers to a usually flimsy physical sheet of paper, plastic, or other suitable physical substrate for images, whether precut or web fed. A "copy sheet" may be abbreviated as a "copy" or called a "hardcopy."

[0011] As to specific components of the subject apparatus or method, or alternatives therefor, it will be appreciated that, as is normally the case, some such components are known *per se* in other apparatus or applications, which may be additionally or alternatively used herein, including those from art cited herein. For example, it will be appreciated by respective engineers and others that many of the particular components illustrated herein are merely exemplary, and that the same novel functions can be provided by other known or readily available alternatives. All cited references, and their references, are incorporated by reference herein where appropriate for teachings of additional or alternative details, features, and/or technical background. What is well known to those skilled in the art need not be described herein.

[0012] Various of the above-mentioned and further features and advantages will be apparent to those skilled in the art from the specific apparatus and its operation or methods described in the example below, and the claims. Thus, this system will be

better understood from this description of a specific embodiment, including the drawing figures (which are approximately to scale) wherein:

[0013] Fig. 1 is a partially schematic frontal view showing one example of how a subject stripper could be utilized for the print media fuser of a xerographic or other printer;

[0014] Fig. 2 is an enlarged partial view of Fig. 1 showing the exemplary roll fuser sheet stripping system; and

[0015] Fig. 3 is a further enlarged view of said exemplary sheet stripping system.

[0016] Schematically shown in Fig. 1 is one example of an otherwise conventional xerographic printer 10 feeding conventional print media sheets 12 to an otherwise conventional roll fuser 20. As better shown in Figs. 2 and 3, the roll fuser 20 here may conventionally have a heated fuser roll 22 and a mating pressure roll 24. As is well known in the art and described in above-cited references, the flimsy print media sheets 12 being xerographically printed have their toner images thermally fused by moving through the fuser 20.

[0017] As is also well known in the art, occasionally some of these sheets 12 being fused, especially flimsy sheets with low beam strength, tend to wrap around one or the other of the fuser rolls 22 or 24 rather than self-stripping therefrom into the downstream sheet path from the fuser. Thus, as is also well known, normal, unmodified stripper fingers (as well as the stripper fingers 26 here) are commonly provided with stripping edges or tips such as 26A riding on or engaging (without damaging) a roll surface under the normal sheet stripping position. The particular form or type of stripper finger, or the number of stripper fingers, is not critical or relevant to this description.

[0018] As may be particularly seen in Figs. 2 and 3, the modified stripper finger 26 here additionally has an internal pneumatic conduit or air channel 27 therein

extending from a flexible hose or other pneumatic connection to conventional or existing machine blower 30. Note that this internal conduit or air channel 27 extends all the way out to closely adjacent to the stripping edge 27, where this air channel 27 has an upwardly directed opening 28, for blowing air under the leading edge 14 of the sheet 12. As shown in Fig. 3, this directed air stream from the upwardly directed opening 28, generally tangential to the roll surface, helps lift that leading edge 14 of the sheet 12 up away from the fuser roll 24 (or 22) and towards the normal downstream sheet path in cooperation with the stripper finger 26 stripping edge 27 catching and lifting of that same sheet leading edge 14. In particular, thereby effectively increasing the radius of the sheet 12 leading edge 14 in the stripping area which would be created by the mechanical stripper finger 26 per se, thereby reducing the chance of the sheet 12 lead edge folding up and jamming at that location, rather than stripping off into the downstream sheet path, shown here by dot-dashed lines and movement arrows.

[0019] An additional function and advantage of the above-described system is to reduce stripper finger marks on the print media sheets, especially those with large area imaging material coverage on coated paper. The above system with its pneumatic sheet lifting assistance directly in the stripping area, over the stripping edge, can reduce sheet scrubbing along the stripper fingers due to the sheet stripping forces. Also, after some period of time a stripper finger may tend to scratch the engaged fuser roll surface, especially with the increased normal force of the stripping edge 26A against the roll during stripping. The roughness of the fuser roll can show on an image with coated paper as a scratch. Yet current air-only strippers can not always strip sheets, especially those with dark lead edge images. Therefore this particular combination of stripping technologies is believed to be beneficial for several reasons.

[0020] The air stream here is provided from within the stripper fingers themselves and ejected therefrom at an appropriate position and angle to assist in sheet stripping and minimize sheet scrubbing along the stripper finger.

[0021] Additionally, as shown in Fig. 3, a part of that same air stream be directed from a different nozzle or opening 29 from the internal conduit 28 to the stripper finger surface under the stripping edge 26A, to minimize the contact force of the stripper finger 26 on the fuser roll 24, and thus reduce wear, or even to provide an "air bearing" allowing the stripper 26 lead edge to effectively partially float very closely on the roll surface but still maintain the stripping edge 26A close enough to the roll surface to catch the lead edge of a sheet 12 adhering thereto, that is, closer than the thickness of the thinnest sheet 12.

[0022] Furthermore, it is believed that a major source of output sheet curl may be from the strain induced in the sheet at the normal stripper finger/fuser roll interface, caused by the tendency of the sheet to follow the fuser roll. The subject positive sheet lifting air stream from within the stripper fingers may minimize this sheet strain at the fuser roll/stripper finger interface. In particular, by this air stream being positioned and directed to increase the radius of curvature of the sheet at the fuser roll/stripper finger interface.

[0023] It will be appreciated that various of the above-disclosed and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Also that various presently unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

[0024] What is claimed is: